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JET PROPULSION LABORATORY INTEROFFICE MEMO

TO M. Emmer FROM G. L. Hobby DATE November 8, 1960

SUBJECT A Device for the Detection of Microorganisms in the Martian Atmosphere (Multivator, by J. Lederberg, for 1964 Mars Split Capsule Lander)

I. Function

1. The device will collect fine dust particles from the Martian atmosphere.

2. The particles will be innoculated into small chambers which will contain a variety of types of liquid media.

3. Optical turbidity measurements will be made of the innoculated chambers at programmed intervals to determine increases in particle number.

4. pH changes in the media will also be measured at programmed intervals to detect possible metabolic activity of the innoculated particles.

II. System Description

1. Sample Collector

The general requirements of the collection mechanism are as follows:

a. Provide the capability of sampling relatively large volumes of the Martian atmosphere in order to compensate for possible low concentrations of viable particles. (Ten to ~~twenty-five~~ 100 liters)

b. Discriminate between particle sizes. Size of particles must be optimum for innoculation into chambers and for having a high probability of having a large number of absorbed microorganisms.

c. The manner of sample collection should be consistent with

simple and effective inoculation of the growth chambers.

2. Inoculation System

   a. The system must be designed to permit unsealing and resealing of growth chambers before and after inoculation.

   b. Inoculum must not interfere with subsequent optical turbidity measurements, or pH measurements.

   c. The amount of inoculum may range from 0.1 to 1.0 cc per chamber.

3. Growth Chamber

   a. Each chamber will provide for 1 milliliter of medium plus inoculated sample.

   b. Walls of chamber must be chemically inert. Toxicity tests should be designed for transit time to Mars or longer, (200 to 250 days).

   c. Walls of chamber not used in optical observations should have very low reflection coefficient.

   d. Chambers must permit optical turbidity measurements.

   e. Chambers should include electrodes or other system for pH determinations.

   f. Total system should consist of 50 to 100 (or more) chambers.

   g. Configuration of the chambers must consider minimum volume requirements and be consistent with a programmed scanning of the total chamber system for optical turbidity and pH measurements.

   h. All growth chambers in the system must have the capability of being sealed before and after inoculation.

4. Detector System

   a. Turbidity

1) Only changes in forward scattering of light should be measured.

2) Light source must be miniaturized and of low power consumption.

3) Light detector of small size, (possibly photoconductive, PbS, PbSe, or CdSe).

b. pH Measurement

1) Range: 1-14

2) Sensitivity: 0.5 pH units

3) Measurements must be made in chamber while sealed.

GLH/vw